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Summary

The development of nanotechnology and the widespread use of silver nanoparticles in various industries is associated with a continuous quest for information on the potentially harmful effects of AgNPs on living organisms. Silver nanoparticles, due to their small size and unique physical and chemical properties, may exhibit genotoxic and cytotoxic effects against eukaryotic cells. When released into the environment, AgNPs remain in the environment, interacting with surrounding ecosystem components, posing a threat to human and animal health. To date, it has been shown that AgNPs can enter the body and subsequently deposit in tissues and organs. Within cells, silver nanoparticles can cause toxic effects by generating ROS, disturbed cell division or DNA damage. Due to different properties of AgNPs, which depend on the production method (chemical, physical, biological) it is extremely important to determine the effect of silver nanoparticles on the animal and human genome. Changes in nuclear chromatin induced by AgNPs can be observed at different stages of its formation, resulting in disruption of genome stability. Cytogenetic instability assays such as, comet assay, micronucleus assay or fragile site assay are used to determine the genotoxic and cytotoxic nature of AgNPs.

The aim of this dissertation was to evaluate chromatin structure and nuclear DNA integrity in somatic cells of two selected representatives of the Canidae family: domestic dog (*Canis familiaris*) and blue fox (*Alopex lagopus*), treated with silver nanoparticles produced by the physical method of high voltage arc discharge, HVAD, *in vitro* using cytogenetic diagnostic tests: Fragile site, micronucleus variant CBMN and comet assay. An additional aim was to try to determine the genotoxic character of silver nanoparticles depending on the applied dose and time of cell exposure.

The material for the study consisted of whole peripheral blood collected from two canine species: domestic dog and blue fox. For each species the experimental group consisted of 10 individuals. Peripheral blood cells were exposed to three colloidal silver solutions. Silver nanoparticles produced by HVAD method and obtained in two solutions: in distilled water - AgNP and in sodium tricitrate solution - AgNP+C were used in the study. The reference solution and indicator for the toxicity of silver nanoparticles was silver nitrate. The toxicity evaluation of the three silver solutions was conducted at three concentrations of 5, 10 and 20 µg/ml and two cell exposure periods of 3h and 24h. The reference sample for the tested silver solutions were the control samples. The effects of the three silver solutions, doses and exposure time on canine peripheral blood cells were analyzed by assessing cell viability, the frequency

of breakage sites in the Fragile site assay, the occurrence of micronuclei, nucleoplasmic bridges and nuclear buds in the cytokinesis block micronucleus assay and disruption of DNA integrity in the comet assay.

Based on the results, it was concluded that silver nanoparticles produced by HVAD physical method cause genotoxic effects on mammalian somatic cells. Low concentrations of silver nanoparticles in the range of 5 to 20 µg/ml were confirmed to cause changes in nuclear chromatin integrity in canine peripheral blood cells. After analysis by comet assay and Fragile site assay, it was found that the genotoxicity of AgNP produced by HVAD method was significantly dose and exposure time dependent. Furthermore, it was shown that peripheral blood cells of the domestic dog had lower genome stability, resulting from a higher susceptibility to damage formation after short-term exposure to the tested colloidal solutions of silver. In contrast, in the peripheral blood cells of the blue fox, the level of damage increased after 24 h of exposure, indicating greater genome stability in this species.

In conclusion, the studies conducted in this dissertation confirmed the genotoxic nature of three silver colloidal solutions, AgNP, AgNP+C and AgNO3, against mammalian somatic cells.

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